

REMARKS

Claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135 and 144-155 are pending in this application. By this amendment, Applicant has amended claims 1, 19, 23, 49, 58, 101 and 102 to include claim language and amendments discussed with the Examiner during an Examiner Interview. Applicant respectfully submits that claims 1, 19, 23, 49, 58, 101 and 102 do not contain new matter and that the invention, as defined by claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135 and 144-155, is patentable over the prior art.

Applicant also submits, in this response, a Statement of the Substance of the Examiner Interview held on May 14, 2010, in the above-identified application with Examiner Chen. Applicants' representative and the Examiner discussed proposed amendments to claim 1 in light of the cited prior art. Applicant's representative stated that Applicant would include the proposed amendments in the response to the pending Office Actions. Entry of this Statement of the Substance of the Examiner Interview is respectfully requested.

Based on the foregoing amendments and the following Remarks, the application is deemed to be in condition for allowance and action to that end is respectfully requested.

I. THE 35 U.S.C. §112 REJECTIONS – WRITTEN DESCRIPTION, ENABLEMENT AND INDEFINITENESS

The Examiner asserts that claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135 and 144-155 are rejected under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement and the enablement requirement. Specifically, the Examiner states that “[c]laims 1, 49 and 101 each recite ‘up to 2500 C’ . . . Claim 101 recites

‘a fourth heater element’. There is no support of this limitation in the Specification. Figs. 5 and 6 each show only three heaters.” (Office Action dated Feb. 2, 2010, page 3).

The Examiner further asserts that claims 23, 58 and 102 are rejected under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Specifically, the Examiner states that “[t]he term ‘high temperature’ in claim 102 is a relative term which renders the claim indefinite . . . claims 23 and 58 each recites ‘said conducting probes are insulated from each other’ while the parent claim 1 (or 55) recites ‘at least one said conducting probe’”. (*Id.*)

As noted above, claims 1, 19, 23, 49, 58, 101 and 102 have been amended in order to overcome the 35 U.S.C. § 112, first and second paragraph rejections. For Example claims 1, 49 and 101 have been amended to require “at temperatures C above the melting point of said liquid metal.” Further, claims 23 and 58 have each been amended to require “at least one conducting probe” while claim 102 has been amended to require “at a temperature for evaporating said liquid metal.” Applicant respectfully submits that the aforementioned amendments to the claims provide the clarification sought by the Examiner. In view of the foregoing, Applicant respectfully requests that the Examiner’s 35 U.S.C. §112 rejection of claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135 and 144-155 be withdrawn.

II. THE 35 U.S.C. § 103 REJECTION OVER SAITO, DELANGE, MERCER, KRITZER, COLOMBO, DAVID, FINICLE, BULLOUGH, BAHNEY, UENO, LEYCURAS, NATELSON AND BACCHI

The Examiner asserts that Claims 1-2, 8-17, 19, 40, 43-45, 47-51, 55, 66-78, 92, 95-97, 99-100, 153 and 155 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Saito,

Japanese Pat. No. JP 62-237721 (hereinafter “Saito”), in view of DeLange, U.S. Patent No. 2,508,500 (hereinafter “DeLange”), in view of Mercer, U.S. Patent No. 5,407,000 (hereinafter “Mercer”) and in further view of Kritzer, U.S. Patent No. 3,133,430 (hereinafter “Kritzer”). The Examiner further asserts that claims 101-105, 107, 109, 115-116, 118-131, 144, 147-149, 151-152 and 154 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer and Kritzer further in view of Colombo, U.S. Patent No. 5,827,371 (hereinafter “Colombo”). The Examiner asserts that claims 3, 18 and 52-53 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer and Kritzer further in view of David, U.S. Patent No. 4,672,813 (hereinafter “David”). The Examiner further asserts that claim 106 is rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer and Colombo, further in view of David. The Examiner further asserts that claims 4 and 54 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer and Kritzer, further in view of Finicle, U.S. Patent No. 5,158,750 (hereinafter “Finicle”). The Examiner asserts that claim 108 is rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer and Colombo, further in view of Finicle. The Examiner further asserts that claims 21-22, and 56-57 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer and Kritzer, further in view of Bullough et al., U.S. Patent No. 4,072,599 (hereinafter “Bullough”). The Examiner further asserts that claims 110 and 111 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer and Colombo, further in view of Bullough. The Examiner asserts that claims 23-24, 26-27, 58-59 and 112-113 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer and Bullough, further in view of Colombo and Bahney, U.S. Patent No. 2,195,071 (hereinafter “Bahney”). The Examiner further asserts that claims 63-65 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito,

DeLange, Mercer and Kritzer, further in view of Ueno, U.S. Patent No. 6,279,330 (hereinafter “Ueno”). The Examiner asserts that claim 28 is rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer and Bullough, further in view of Ueno. The Examiner asserts that claim 117 is rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer, Bullough and Colombo, further in view of Ueno. The Examiner also asserts that claims 29-31 and 81-83 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer and Kritzer, further in view of Leycuras, U.S. Pat. App. Pub. No. 2004/0238526 (hereinafter “Leycuras”). The Examiner further asserts that claims 133-135 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer, Bullough and Colombo, further in view of Ueno. The Examiner asserts that claims 41-42, 46, 93-94 and 98 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer and Kritzer, further in view of Natelson, U.S. Patent No. 3,687,632 (hereinafter “Natelson”), in further view of Bacchi et al., U.S. Pat. App. Pub. No. 2003/0055533 (hereinafter “Bacchi”). The Examiner asserts that claims 145-146 and 150 are rejected under 35 U.S.C. § 103(a) as being unpatentable Saito, DeLange, Mercer, Kritzer, Bullough and Colombo, further in view of Natelson and Bacchi. The Applicant respectfully traverses the Examiner’s rejections, and asserts that Saito, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi, alone or in combination, do not teach, suggest, or render obvious all of the limitations as required in claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135 and 144-155.

As noted above, Applicant has amended claims 1, 19, 23, 49, 58, 101 and 102 so as to more clearly distinguish the invention, as defined by such claims, over the prior art. Applicant submits that support for the limitations in independent claims 1, 49 and 101 is expressly or

inherently disclosed in the specification of U.S. Patent Pub. No. 2005/0229856 (Application No. 10/829,148) in at least paragraphs [0088], [0092]-[0094].

Referring initially to claim 1, the Applicant respectfully submits that Saito does not disclose, teach, or suggest the present invention a liquid metal evaporation source comprising, among other things, “a nosecone coupled to said evaporator, said nosecone comprising a second cylindrical body, at least one annular ring coupled to an external surface of said second cylindrical body and a tapered bore from a first opening adjacent to said liquid metal to a second opening remote from said liquid metal“, “wherein said nosecone disperses said evaporated liquid metal from said first opening to said second opening”, “at least one conducting probe coupled to said nosecone for regulating a height of said liquid metal within said evaporator“, “wherein said at least one said conducting probe comprises a third end coupled to said second cylindrical body and a fourth end residing between said first opening and a surface of said liquid metal for preventing condensation of said evaporated liquid metal on said second cylindrical body“ and “wherein said at least one annular ring is coupled to said second end for sealing said second end to said nosecone.” Neither do DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi teach these features.

Applicant’s invention as described in the specification of the invention is a liquid metal evaporation source for use in Molecular Beam Epitaxy and related metal vacuum deposition techniques. (U.S. Patent Pub. No. 2005/0229856, Abstract). The invention includes an evaporator, maintained at a high temperature, to evaporate a liquid metal and a reservoir maintained at a temperature above the melting point of the metal for holding the liquid metal source while a hollow transport tube is provided for connecting the evaporator and the reservoir. (U.S. Patent Pub. No. 2005/0229856, Abstract). A nosecone and level sensor is inserted into the

evaporator. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). The bottom end of the level sensor point resides below the bottom nosecone orifice so that the nosecone can be maintained at a higher temperature compared to the liquid metal that is evaporated and prevent condensation of small metal droplets on the nosecone that can fall back into the liquid metal, which can cause defects in the deposited metal films. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). The level sensor contact position may also be adjusted to reduce the volume of liquid metal contained within the evaporator crucible. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). Neither do DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi teach these features.

In contrast, Saito merely teaches an electrode disposed inside a liquid metal in a molecular beam source cell. (Saito, Detailed Description). The Saito system employs the source cell to deposit evaporated liquid metal onto a substrate through evaporation. (Saito: page 5; figure 1). Also, an electrode resides inside the liquid, near the opening of the cell, to detect the liquid level of the source cell. (Saito, page 5, figure 1). Further, DeLange merely discloses a heating element in an intermediary tube transporting the liquid for heating the liquid. (DeLange, figure 3; column 3, line 53-59). A heating element is provided for maintaining the metal in a molten state. (DeLange, column 5, line 40-59). Further, Mercer teaches a thermocouple for measuring the temperature of molten metal for the purpose of temperature control. (Mercer, column 3, line 58-60). Kritzer teaches a refrigerating system comprising tubing stock to connect the evaporator to the accumulator and condenser. (Kritzer, figure 1 and 2). The tubing stock in Kritzer is provided to eliminate possible leaks in refrigerating system. (Kritzer, column 2, line 21-24). Colombo teaches a crucible comprising a cylindrical body and a conical insert having a pronounced positive draft. (Colombo: column 5, line 7-25). Also, differential heating provided

by the dual filaments minimizes hydrodynamic instability and rapid depletion effect common in other hot lip source designs. (Colombo: column 5, line 26-29). David merely teaches densified graphite as being useful for high temperature resistance and low thermal expansion, (David: column 1 lines 50-53), while Finicle and Bullough also teach using pyrolytic graphite and densified graphite respectively for refractory materials. (Finicle: Abstract; Bullough: Abstract).

More importantly, Saito does not teach “a nosecone coupled to said evaporator”, “at least one conducting probe coupled to said nosecone for regulating a height of said liquid metal within said evaporator“, and “wherein said at least one said conducting probe comprises a third end coupled to said second cylindrical body and a fourth end residing between said first opening and a surface of said liquid metal for preventing condensation of said evaporated liquid metal on said second cylindrical body.” There is no teaching in Saito of a conducting probe residing between the liquid metal and the nosecone opening to prevent defects in vapor deposition. Also, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi do not teach these features.

In light of the comments above, the Applicant submits that Saito, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi, alone or in combination, fail to teach, render obvious, or even suggest, the features of claim 1. The Applicant respectfully asserts that claim 1 is patentable over the cited references.

Further, as claims 2-4, 8-19, 21-24, 26-31 and 40-48 depend either directly or indirectly from independent claim 1, they contain all of the elements and limitations of the claim from which they depend. Claims 2-4, 8-19, 21-24, 26-31 and 40-48 are therefore, patentable over Saito, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi for at least the same reasons as independent claim 1. Therefore, the

Applicant respectfully requests that the Examiner withdraw the 35 U.S.C. § 103(a) rejection of claims 2-4, 8-19, 21-24, 26-31 and 40-48.

Referring next to independent claim 49, Applicant points out that the limitations of claim 49 are analogous to those discussed above for claim 1. As was discussed regarding claim 1, Saito does not teach Applicant's invention for a liquid metal evaporation source for use in Molecular Beam Epitaxy and related metal vacuum deposition techniques. (U.S. Patent Pub. No. 2005/0229856, Abstract). The invention includes an evaporator having a nosecone and level sensor inserted into the evaporator. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). The bottom end of the level sensor resides below the bottom nosecone orifice so that the nosecone can be maintained at a higher temperature compared to the liquid metal that is evaporated, thereby preventing condensation of small metal droplets on the nosecone. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). These droplets, if formed, can fall back into the liquid metal causing defects in the deposited metal films. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). The level sensor contact position may also be adjusted based on user preference. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). Neither do DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi teach all these features.

As was discussed above, Saito merely teaches an electrode disposed inside a liquid metal in a molecular beam source cell, (Saito, Detailed Description), having an electrode residing inside the liquid, near the opening of the cell, to detect the liquid level of the source cell. (Saito, page 5, figure 1), and includes a heating element in an intermediary tube transporting the liquid for heating the liquid and is provided for maintaining the metal in a molten state (DeLange, figure 3; column 3, line 53-59; and column 5, line 40-59). As previously mentioned, Kritzer

teaches a refrigerating system comprising tubing stock to connect the evaporator to the accumulator and condenser, system. (Kritzer, figure 1 and 2; and column 2, line 21-24), while Colombo teaches a crucible comprising a cylindrical body and a conical insert having a pronounced positive draft. (Colombo: column 5, line 7-25). Also, differential heating provided by the dual filaments minimizes hydrodynamic instability and rapid depletion effect common in other hot lip source designs. (Colombo: column 5, line 26-29). David merely teaches densified graphite as being useful for high temperature resistance and low thermal expansion, (David: column 1 lines 50-53), while Finicle and Bullough teach using pyrolytic graphite and densified graphite respectively for refractory materials. (Finicle: Abstract; Bullough: Abstract).

More importantly, Saito does not teach any system, feature or element “a nosecone coupled to said evaporator, said nosecone comprising a cylindrical body, at least one annular ring coupled to an external surface of said cylindrical body and a tapered bore from a first opening adjacent to said liquid metal to a second opening remote from said liquid metal, wherein said nosecone disperses said evaporated liquid metal from said first opening to said second opening” and “wherein said conducting probe comprises a first end coupled to said cylindrical body and a second end residing between said first opening and a surface of said liquid metal for preventing condensation of said evaporated liquid metal on said cylindrical body” as required in claim 49. Neither do DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi teach these features. In light of the comments above, the Applicant submits that Saito, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi, alone or in combination, fail to teach, render obvious, or even suggest, the features of claim 49. The Applicant respectfully asserts that claim 49 is patentable over the cited references.

Further, as claims 50-59, 63-78, 81-83 and 92-100 depend either directly or indirectly from independent claim 49, they contain all of the elements and limitations of the claim from which they depend. Claims 50-59, 63-78, 81-83 and 92-100 are therefore, patentable over Saito, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi for at least the same reasons as independent claim 49. Therefore, the Applicant respectfully requests that the Examiner withdraw the 35 U.S.C. § 103(a) rejection of claims 250-59, 63-78, 81-83 and 92-100.

Referring finally to independent claim 101 and its dependent claims 102-113, 115-131, 133-135 and 144-155, Applicant points out that the limitations of independent claim 101 are analogous to those discussed in independent claim 1. As was previously discussed in claim 1, Saito does not teach the limitations of the present invention, which require, among other things, a liquid metal evaporation source for use in Molecular Beam Epitaxy and related metal vacuum deposition techniques. (U.S. Patent Pub. No. 2005/0229856, Abstract). Importantly, the invention includes an evaporator having a nosecone and level sensor inserted into the evaporator, (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]), with the bottom end of the level sensor residing below the bottom nosecone orifice so that the nosecone can be maintained at a higher temperature compared to the liquid metal that is evaporated. This is important because it prevents condensation of small metal droplets on the nosecone. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). These droplets, if formed, can fall back into the liquid metal causing defects in the deposited metal films. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). The level sensor contact position may also be adjusted based on user preference. (U.S. Patent Pub. No. 2005/0229856, paragraph [0093]). As was shown with respect to claims 1 and

49, neither do DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi teach all these features.

In light of the comments above, the Applicant submits that Saito, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi, alone or in combination, fail to teach, render obvious, or even suggest, the features of claim 101. The Applicant respectfully asserts that claim 101 is patentable over the cited references.

Further, as claims 102-113, 115-131, 133-135 and 144-155 depend either directly or indirectly from independent claim 101, they contain all of the elements and limitations of the claim from which they depend. Claims 102-113, 115-131, 133-135 and 144-155 are therefore, patentable over Saito, DeLange, Mercer, Kritzer, Colombo, David, Finicle, Bullough, Bahney, Ueno, Leycuras, Natelson and Bacchi for at least the same reasons as independent claim 101.

III. CONCLUSION:

In view of the foregoing, the application is deemed to be in condition for allowance and action to that end is respectfully requested. Allowance of pending claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135 and 144-155 is, therefore, respectfully requested.

Should any changes to the claims and/or specification be deemed necessary to place the application in condition for allowance, the Examiner is respectfully requested to contact the undersigned attorney to discuss the same.

Respectfully Submitted,

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David M. Hill
Reg. No. 46,170
Ward & Olivo
380 Madison Avenue
New York, New York 10017
212-697-6262